

END SEMESTER EXAMINATION MAY-2023

Course Name: - B.Tech(CSE, CE, EE, ECE, ME)

Semester:- 2nd

Paper Name: - Engineering Mathematics-II

Paper Code:- TBS-202

Time - 3 Hrs + 20 minutes per hour extra time for V.I. & examinees with writer.

Max Marks-70

समय- 3 घण्टे + 20 मिनट प्रति घंटे अतिरिक्त-दृष्टिबाधित एवं साह लेखक परीक्षार्थियों के लिए।

अधिकतम अंक-70

Instructions:

- The question paper consists of three sections namely A, B, C. All sections are compulsory.
- Section A- Each question carries 3 mark. All questions are compulsory.
- Section B- Answer any 5 out of 7 given questions in maximum hundred (100) words. Each question carries 7 marks.
- Section C- Answer any 2 out of 3 given questions in maximum five hundred (500) words. Each question carries 10 marks.

निर्देश:

- प्रश्न पत्र में तीन खण्ड अ, ब, व स हैं। सभी खण्ड अनिवार्य हैं।
- खण्ड-अ में प्रत्येक प्रश्न तीन अंक का है। सभी प्रश्न अनिवार्य हैं।
- खण्ड-ब में सात प्रश्नों में से किन्हीं पाँच प्रश्नों के उत्तर अधिकतम 100 शब्दों में दें। प्रत्येक प्रश्न सात अंक का है।
- खण्ड-स में तीन प्रश्नों में से किन्हीं दो प्रश्नों के उत्तर अधिकतम (500) शब्दों में दें। प्रत्येक प्रश्न 10 अंक का है।

Section - A (खण्ड-अ)

Objective Questions (वस्तुनिष्ठ प्रश्न)

1. Answer all the following questions.

5×3=15

निम्नलिखित सभी प्रश्न अनिवार्य हैं।

- i) The partial differential equation $y \frac{\partial^2 u}{\partial x^2} + 2x \frac{\partial^2 u}{\partial x \partial y} + y \frac{\partial^2 u}{\partial y^2} = 0$ is hyperbolic if
- a) $x^2 > y^2$
 - b) $x^2 < y^2$
 - c) $x^2 + y^2 > 1$
 - d) $x^2 + y^2 = 1$
- ii) The complementary function of $r - 7s + 6t = e^{x+y}$ is:
- a) $f_1(y-x) + f_2(y-6x)$
 - b) $f_1(y+x) + f_2(y+6x)$
 - c) $f_1(y+2x) + f_2(y-2x)$
 - d) $f_1(y+3x) + f_2(y-4x)$
- iii) Laplace transform of a function $F(t)$ is $\frac{s-a}{(s-a)^2+b^2}$ then $F(t)$ is
- a) $e^{at} \cos bt$
 - b) $e^{at} \sin bt$
 - c) $e^{bt} \cos at$
 - d) $e^{bt} \sin at$
- iv) The Inverse Fourier sine transform of a function $F(s)$ is
- a) $f(x) = \frac{1}{\sqrt{2\pi}} \int_0^\infty F(s) \cdot \sin sx \, ds$
 - b) $f(x) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^\infty F(s) \cdot \sin sx \, ds$
 - c) $f(x) = \sqrt{\frac{2}{\pi}} \int_0^\infty F(s) \cdot \sin sx \, ds$
 - d) $f(x) = \sqrt{\frac{2}{\pi}} \int_{-\infty}^\infty F(s) \cdot \sin sx \, ds$

v) Which one is true recurrence relation for Bessel's function $J_n(x)$

- a) $\frac{d}{dx} [x^n J_n(x)] = x^n J_{n-1}(x)$
- b) $\frac{d}{dx} [x^{-n} J_n(x)] = -x^n J_{n+1}(x)$
- c) $\frac{d}{dx} [x^{-n} J_n(x)] = x^{-n} J_{n+1}(x)$
- d) $J_n(x) = \frac{x}{2n} [J_{n-1}(x) - J_{n+1}(x)]$

Section - B (खण्ड-ब)

Short Answer Questions (लघुउत्तरीय प्रश्न)

2. Answer any five of the following questions in maximum 150 words.

5×7=35

निम्नलिखित में से किन्हीं पाँच प्रश्नों के उत्तर अधिकतम 150 शब्दों में दें।

- i. Solve $r - 3s + 2t = e^{2x-y} + e^{x+y} + \cos(x+2y)$.
- ii. The vibrations of an elastic string is governed by the partial differential equation $\frac{\partial^2 u}{\partial t^2} = \frac{\partial^2 u}{\partial x^2}$. The length of string is π and the ends are fixed. The initial velocity is zero and the initial deflection is $u(x, 0) = 2(\sin x + \sin 3x)$. Find the deflection $u(x, t)$ of the vibrating string for $t \geq 0$.
- iii. Find the inverse Laplace transform of $\frac{6}{2s-3} - \frac{3+4s}{9s^2-16} + \frac{8-6s}{16s^2+9}$.
- iv. Solve $y'' + 3y' + 2y = te^{-t}$, $y(0) = 1$, $y'(0) = 0$ by using Laplace transform.
- v. Find the Fourier series for $f(x) = 4 - x^2$, $-2 \leq x \leq 2$.
- vi. Find the Fourier transform of e^{-ax^2} .
- vii. Prove that $(2n+1)xP_n = (n+1)P_{n+1} + nP_{n-1}$.

Section - C (खण्ड-स)

Descriptive Questions (विवरणात्मक प्रश्न)

3. Answer any two of the following question in maximum 300 words.

2×10=20

निम्नलिखित में से किन्हीं दो प्रश्नों के उत्तर अधिकतम 300 शब्दों में दें।

- i) (a) Find the inverse Laplace transform of $\frac{3}{s-2} + \frac{6}{9s^4} + \frac{2s}{s^2+25}$.
- (b) Find the general solution of $x(z^2 - y^2)p + y(x^2 - z^2)q = z(y^2 - x^2)$.
- ii) (a) Solve $(mz - ny)p + (nx - lz)q = ly - mx$.
- (b) Find the Fourier Sine transform of e^{-ax} .
- iii) (a) Find the solution of wave equation $\frac{\partial^2 y}{\partial t^2} = c^2 \frac{\partial^2 y}{\partial x^2}$ such that $y = P_0 \cos pt$ (P_0 is a constant), when $x = l$ & $y = 0$ when $x = 0$.
- (b) Prove that $\frac{d}{dx} [x^n J_n(x)] = x^n J_{n-1}(x)$.